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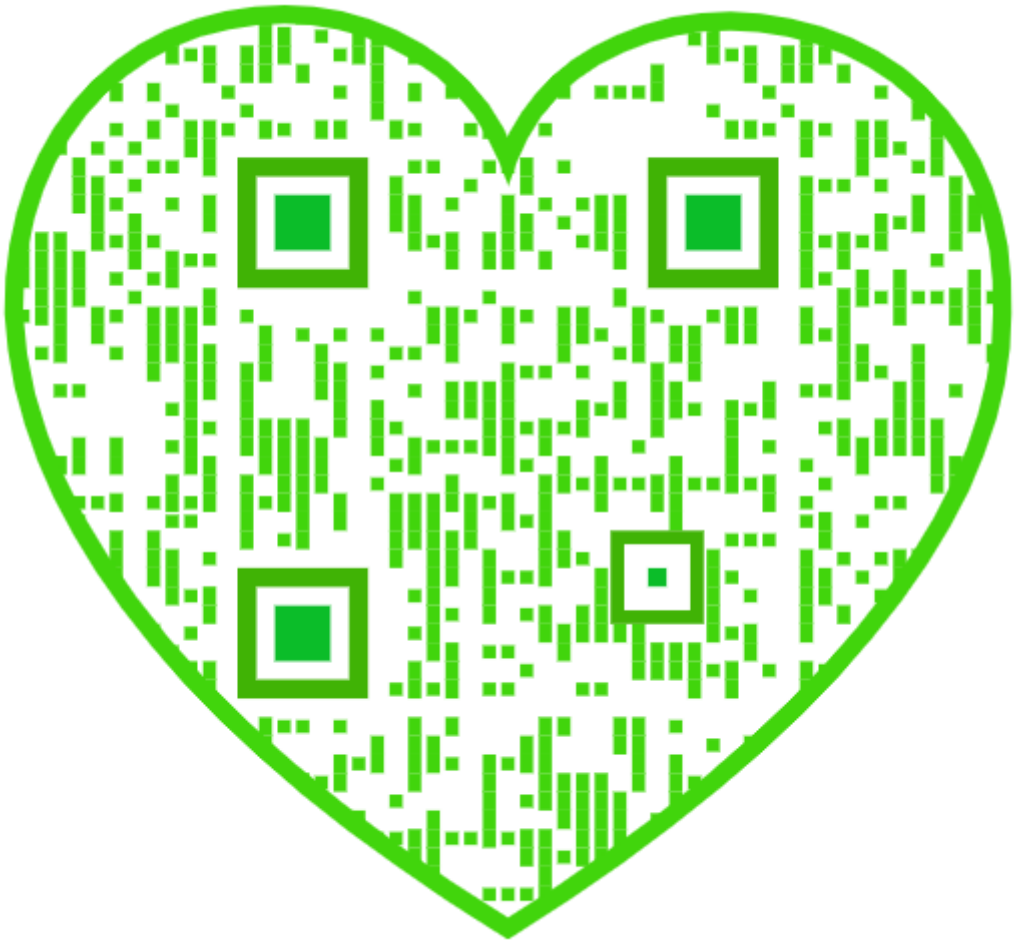

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Editor of *The British Bee Journal* and *The Bee-Keeper's Record*

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BEE-KEEPING IN WAR-TIME

I

THE DWELLINGS OF BEES

THE hive bee is wild by nature; its natural home is not a hive, but the cavity of a tree or other place which is well protected from damp.

When first domesticated it was housed in a straw skep, the shape of which is so well known that it needs no description here. The method of obtaining the honey was very crude. It consisted of first suffocating the bees by sulphur fumes, then breaking out the combs and placing them in some porous material through which the honey could drain; when it ceased percolating through this material, that remaining in the mess of comb was squeezed out by hand pressure. In this way nothing was lost; pollen, propolis, and even the juices from the grubs in the cells entered into the honey. The residue was then soaked in water; the sweet liquor thus obtained was fermented and provided that ancient powerful alcoholic drink called "mead." The wax melted from the skimmings was used by our grandmothers for polishing their floors and furniture.

The dwellings provided for the bees by the modern bee-keeper are very different; they conform to the natural requirements of the bee, and at the same time permit their owner to have full control of both bees and combs. This was impossible with the skep; the combs being attached to the sides of the hive, it was impossible to remove them without breaking them from their attachment.

Modern hives are called "movable comb hives," because the bees are made to build their combs in movable wooden frames. The difficulty with the beginner is to know what kind of hive to adopt. There are two forms—a double-walled one called the "W.B.C. hive," and a single-walled one made by various makers. In each case the outside design varies. The internal measurements of all hives, so far as the width is concerned, are the same; there is a slight variation in the

length. The double-walled hive is the most costly, but the extra outlay is well repaid by comfort in management.

The double-walled hive consists of a floor-board, to the joists of which are attached four splayed legs; on the floor-board rests the brood chamber, which is a lidless and bottomless box; fitting into this are ten frames, which hang by lugs on to a metal runner, so that they hang clear of the hive side by a quarter of an inch. This measurement must be kept accurately. If less is given, then the bees glue the frame to the hive side with propolis; if more, they build comb in between, in either case making the operation of removing the comb a very difficult one. The space under the frame, between the bottom bar and the floor-board, is half an inch, to allow free passage for the in coming and out-going bees. The frames are spaced one and a half inches from centre to centre by metal ends of this width slipped on to the lugs. The frames are now made standard size, as is also the inside width of all hives, so that the frames are interchangeable in any hive. A division board to fit just tight into the brood chamber, for reducing the number of combs occupied by the bees, completes the fittings of this portion of the hive. The brood chamber is surrounded by an outer case, the joints of which, between it and the floor-board, are broken by means of plinths at the back and on two sides; on the front is a porch, which gives shade to the entrance from sun and rain; in the bottom edge of the porch is a recess, in which a couple of wooden slides are inserted to regulate the width of the entrance according to the season of the year, or to close it altogether if necessary. When the outer case is in position there is an air space between it and the brood chamber; this makes the latter warmer in winter and cooler in summer than a single-walled hive. For obtaining surplus honey, supers for the storage of comb honey, called section racks, are used; or if it is desired to work for honey in a liquid form, then shallow frames are used in a box exactly the same size as the brood chamber in every way except the depth, this being shallower. To build the hive up to accommodate the supers, lifts six inches deep, with plinths on all four bottom edges to break the joints, are used. A water-tight roof completes the hive.

A single-walled hive differs in so much that there is no outer case, and usually only one lift, so that the number of supers on the hive at any one time is limited to two, whereas

with the W.B.C. hive building up can be carried out to any extent.

In commencing bee-keeping it will save much disappointment and annoyance if only one kind of hive is used. A museum of all the different types is a source of endless worry, as the parts are not interchangable, which is the case when only one pattern is used.

Hives cost money, therefore the thrifty person saves this expense by constructing his own. The work is within the scope of any ordinary intelligent person, male or female. Although working drawings can be purchased for this purpose, the better plan is, after having decided upon the pattern of hive to be adopted, to borrow or buy one as a model to work from; by this means the work is made much more simple and far more accurate. Inexpensive material such as "Quaker oat boxes" or "Tate's cube sugar boxes" can be utilised. A good water-tight roof is essential; this can be made by covering the roof with calico which is then well painted.

II

THE POPULATION OF THE HIVE

A KNOWLEDGE of the inhabitants of the hive, and the contribution of each one to its economy, is essential for success in bee-keeping. If this is not obtained, then one of two things is bound to happen: either the bees will suffer or the owner will not get the best result from his stock.

It is in the summer only that the hive has its full complement of inhabitants; these consist of one queen, about forty thousand workers, and several hundred drones. In the winter, drones are absent.

The queen does not rule the hive, as might be supposed from her name; at the same time she is the most important bee in the home, for, being fully developed, she is the mother of every other bee in the colony. The formation of the queen's body is different from that of the other bees; she is slimmer and longer, the wings are a little shorter and fold more neatly, the coloration of the back is darker. Her movements over the comb are slow and majestic. Under natural conditions the queen will live about five years, but after her second season, which is the best, her power of pro-

*

ducing workers in large numbers gradually depreciates, until eventually she becomes a breeder of drones only. In their natural state the bees depose an old queen, replacing her with a princess. The wise bee-keeper of to-day replaces the queen after she has attained the age of two years. The reproductive powers of the mother are marvellous: when in her prime, *i.e.* two years old, she is capable of laying from one to three thousand eggs per day. The egg laid is just as perfect as that laid by the hen, and is identical in composition. The queen does no work except the laying of eggs; even her food is digested for her by the workers, and given all ready for assimilation. By this means the workers, who are the true rulers of the hive, regulate the queen in her maternal duties: if an abundance of food is given to her, she lays a large number of eggs; the quantity is reduced, if necessary, by feeding her less generously.

There is but one queen in each hive; a dual monarchy is impossible—the presence of a second queen would mean a fight between them until one was killed. Generally it is the older one which succumbs, she being incapable of using her sting with such fatal effect as the young one; thus does nature provide for the survival of the fittest.

The life of the queen is spent within the hive; on two occasions only does she leave it for the outside world: first as a virgin, to meet the drone in marriage, which can only take place when in flight; this when once accomplished lasts for life. She then returns to the hive and within about forty-eight hours commences to lay, and can then produce at will either fertile or unfertilised eggs—the former producing females only, the latter giving the males. This, called "parthenogenesis," is one of the interesting features of bee life which the limited scope of this book does not admit of a full description being given. To put it briefly, the drone has no father, and can be produced by a mother that has never been mated; the females, queens or workers, can only be produced by a married mother. The second time is when she goes out with a swarm.

The queen has a sting which is curved, its only use being to fight a rival. The workers take very great care of the queen; not only do they feed her, but they clean down her body, protect her, and anticipate her every need.

The workers are the drudges of the hive; they are undeveloped females. Their whole existence is spent in labouring

unselfishly for the welfare of the community. So hard do they labour in the summer time that death ensues in about six weeks; the wastage of the population at this period is enormous, hence the necessity for the marvellous reproductive powers of the mother, to keep up the working population of the hive. Workers which hatch out in the autumn have very little work to do, so they live through the winter and commence the work of the hive in the early months of the next year. They have a sting, which is used for defensive purposes only; in using this weapon the bee generally sacrifices its life, for, on account of its construction, it is difficult to withdraw, usually remaining in the wound inflicted; this severance causes death. The labours of the worker comprise the following: gathering nectar (not honey) and converting it into honey (the difference between nectar and honey is great, the former consisting of cane sugar, the latter of grape sugar, hence the great food value of honey on account of its being easily assimilated by the human stomach), secreting wax, building the combs, hatching the eggs, feeding the larva in the cells, also the adult queen and drones, cleaning the home, and acting as undertaker for the dead. Though they are the smallest bees in the hive, they are the most active.

Drones are the male bees; as only one drone is required to mate each queen, they are not required in large numbers. They are bulky fellows and have no sting. Like the queen, they depend for their living upon the workers, who give them digested food. About August the swarming season is over, the drones are then no longer needed, so, to save the useless consumption of food and time spent in attending to their requirements, they are killed off. This is accomplished by the workers putting their wings out of action by biting them at the joint; they are then unceremoniously pitched out of the hive on to the ground to perish.

III

SWARMS, NATURAL AND ARTIFICIAL

COLONIES of bees increase by what is termed swarming. With the majority of living creatures increase is obtained by young, with the bee this is reversed, the old bees and old queen going out to found the new home.

The queen commences her maternal duties about the last week in January. At first only a few eggs are laid; the number of bees being small they can only brood over, and keep up the necessary temperature (about 98 degrees), on a limited number of cells. As the young hatch out, and the colony increases, more eggs are laid each day. Gradually the numbers increase to such an extent that about May the hive becomes over-populated. When this occurs the bees prepare for swarming. The first outward indication of this condition is a small cluster of bees hanging at the entrance in the evening; as the days go by this cluster increases each evening until eventually it remains there during the day-time as well. Very little work goes on in the hive, a large number of bees being unemployed on account of the congested state of the home. An inspection of the combs when the first few bees commenced to cluster at the entrance would reveal the fact that the bees had commenced to build queen cells, so that a new mother might be brought into existence when the old one left. Generally from eight to ten of these cells will be found.

One morning, when the oldest princess is due to emerge in the course of the next few days, great excitement prevails in the hive, the bees rush about excitedly both inside and on the alighting board. The old bees then take into their stomachs sufficient food to last them for four days. They are going to a new home, which is combless and foodless, so nature has ordained that they shall be capable of carrying sufficient food to last them until combs are built and food stored in the new residence.

About 10 a.m. the bees commence to rush pell mell out of the hive, and fly round in a circle until the air is full of the insects, all emitting a contented hum, which can be recognised many yards away by the experienced bee-keeper. Eventually the old queen joins the crowd and away they go to settle on the branch of a tree or some other position previously selected by the scouts sent out from the hive for this purpose. The swarm contains anywhere from fifteen to twenty-five thousand bees. They settle in a large pear-shaped cluster; as soon as all have settled down they should be hived into a temporary home, there to remain until the evening, when they can be run into their permanent abode.

Sometimes the swarm is disinclined to settle. If this restlessness exhibits itself, it is quite possible that they may

take a long, long flight before alighting, or they may even enter some cavity such as a disused chimney flue, or under the roof of a house difficult of access, and from which it is almost impossible to evict them. To prevent them absconding in this manner, water should be sprinkled amongst them by means of a garden syringe, or failing this, handfuls of earth thrown up amongst them gives the impression that it is raining, and down they come to cluster.

The temporary home may consist of an empty straw hive; a wooden bucket or box will do just as well. The box bucket or skep is held under the cluster with one hand, while with the other the branch upon which the bees are resting is given a few vigorous shakes, so that they are dislodged and fall into the waiting receptacle. This is then turned over gently to give the bees time to gain foothold upon its interior to cluster; it should stand on a board with a brick under the edge to allow the hot air to come out and cool air to enter. Bees will die very quickly unless ample ventilation is provided. To keep them cool and contented, their resting-place must be shaded from the sun by placing over it an opened umbrella, or covering it lightly with a sheet; the latter may with advantage be damped with cold water from time to time.

The disadvantage of obtaining increase by natural swarms is that much time is wasted by watching for their exit, and when they do come out there is always the danger of losing them. On this account the keeper of bees in modern hives who requires increase makes it by artificial means. Knowing the habits of the bee this is an easy matter.

The cardinal points to remember in making artificial swarms are that bees locate position and not the hive, and that it is the old flying bees and old queen which constitute the swarm.

It is useless to try to make artificial swarms from weak stocks. Commence to stimulate those it is desired to manipulate for this purpose about the end of March, or beginning of April, according to the weather, so that the hive is teeming with bees at the beginning of May.

About ten o'clock on the morning of a day that is warm, and the sun shining, bring out the new hive, which has been fully prepared by painting the outside, and fitting the frames with full sheets of wired worker base foundation. Examine the combs in the stock to be dealt with until the queen is

found, then remove the central frame from the new hive, and put in its place the comb with the queen and adhering bees, close up the combs in the parent stock, place the frame of foundation removed from the new hive so that it is the one nearest the hive wall on one side, wrap both lots up warmly, move the parent stock to a new site some few yards away, put the new hive on the position it occupied. The old foraging bees go out to work from the old hive in its new situation; upon their return they go to the old position, which is now occupied by the new hive in which are a few bees and the old queen. In this way the old bees, which constitute a swarm, are sifted out. Young bees do not fly until they are fourteen days old; the parent hive retains all these for its population just as it would if a natural swarm had issued. Finding they are queenless these young bees immediately set to work and rear a queen, which, after she has been mated, forms the head of the colony. The only difference between a natural and an artificial swarm is, that there is a longer period of queenlessness in the latter than the former.

IV

HOW TO ESTABLISH AND MANAGE BEES

THE best and cheapest way to commence bee-keeping is by means of a swarm obtained as early in the spring as possible. If a stock, *i.e.* bees on their combs established the previous season, is bought, it will be more expensive—the former costing from fifteen to thirty shillings, the latter from forty shillings to three pounds. With a swarm there is not much fear of disease being present, as there is with a stock. The combs have to be built by the swarm; a record of their age can be kept so that they can gradually be renewed as required, thus there will always be a few new combs in the hive with full-sized cells to keep up the size and stamina of the bees. The advantage of commencing with a stock is that a return in honey will be obtained the first year, whereas this is not always possible with a swarm. If the latter establishes itself and stores sufficient food to last through the winter, the bee-keeper is satisfied. All things considered, there is no doubt that the experience gained in watching the development of a swarm into a stock is ample compensation for the loss of a little honey, apart from the saving in cost.

The hive should be obtained in January, the roof covered with calico, and the whole exterior painted with three coats of good white paint. If this is done early it will give the paint ample time to harden before the hive is required for use, thus avoiding the inconvenience caused by the various parts sticking together, which is bound to happen if they are put in position before the paint is quite hard.

The brood frames are fitted with full sheets of worker base comb foundation. Foundation is pure beeswax sheeted and impressed with the base of cells, either worker or drone as required; by its use perfectly straight combs, of either kind of cells, are obtained in any desired position. It also saves the bees a good deal of labour by providing them with a certain amount of wax, the secretion of which entails a great deal of labour and the consumption of much food. The foundation should be wired into the frame; this is accomplished by stretching very thin tinned wire across the frame, attaching it to the middle of either end bar either by hooks or threading it through holes made with a bradawl. The sheet of foundation is then inserted into a saw-cut which runs right along, and in the centre of, the top bar. The frame is now laid on a board, which fits loosely inside to hold the foundation up to the wire, when a small serrated wheel, which has been previously heated, is run along the wire, forcing it into the foundation. It is thus held quite rigid in the frame, and when the combs are built makes them very strong, in the same way that steel bars placed in cement castings give us reinforced concrete.

Our next care is to choose a suitable position for the hive. It is a mistake to imagine that because bees are creatures which love sunshine, they should be placed in the warmest position available. Too much sun on their home is bad for them, and will cause much distress. Extreme shade is equally unsatisfactory. A walled-in garden where there is very little circulation of air, or close up to the south side of a wall, is not a good position. Choose a place which is shaded during part of the day and where air can play freely round the hive at all times, for instance at the side of a standard fruit tree or a pergola. The entrance should face south-east; the back of the hive should come close up to a path, to avoid treading on cultivated ground when manipulating the bees. Bees object to be hindered in their work by people passing in front of their home; if this occurs, they at once attack the

intruder. The ground in front of the hive for at least a yard must be kept clear of all vegetation.

The legs should stand on bricks to give stability and also to prevent decay of the wood. The floor-board should stand perfectly level from side to side, also from back to front if the frames run parallel with the entrance; if they run at right angles, which is generally the case, then the front should slope about half an inch to throw out the moisture which condenses inside.

The brood chamber is now put in position on the floor-board; the tops of the frames must be covered with a quilt, *i.e.* a piece of calico or ticking cut just a little larger than the size of the brood chamber, to keep the bees confined to the frames and also to keep them warm; over this place about three pieces of some good thick warm material, such as house flannel, or several layers of neatly folded newspapers will serve the same purpose.

Upon the arrival of the swarm in its travelling case, it should be placed in a cool room, such as the cellar, until about seven o'clock (normal time) in the evening, when it can be put into the hive.

The hive is prepared for its reception by removing all the outer casing, if a W.B.C. The entrance is made about a couple of inches high, by propping up the front of the brood chamber with the entrance slides; a board about three feet long, the same width as the floor-board, is placed sloping from the alighting board to the ground; over this spread a cloth to make a smooth surface for the bees to travel up. Open the travelling case containing the swarm, shake it vigorously to loosen the bees, then shake them all out on to the cloth about six inches away from the entrance to the hive. The natural inclination of bees is to travel up hill; the inclined plane thus provided conducts them into the hive. When all are inside the brood chamber is lowered to its proper place and the outer portions restored to their normal position.

It is advisable to feed a swarm for about a week after hiving. The food given is syrup made from white cane sugar; to one pound of sugar add one pint of water, heat over the fire until the sugar is dissolved. This syrup is put into a feeding bottle having a perforated metal cap with an index finger, which fits on to a feeding stage placed over a hole cut for the purpose in the calico quilt. The number of holes

to which the bees are allowed access to suck the food is regulated by turning the index finger to the number on the stage; these numbers range from one to nine, and whichever number the finger is set to allows that number of holes to be exposed through a slot in the metal work of the stage. The food must be given in the evening and about new-milk warm.

As already indicated a swarm does not, as a rule, do more than establish itself and store sufficient food for the winter, though at times they not only do this, but give a good surplus as well.

The second season, if all goes well, the stock will reach full strength about the beginning of May; if more room is not provided at that period the bees will swarm as already explained.

The method of present-day bee-keeping is to prevent this by giving room in advance of requirements; this is carried out by means of the supers. These are of two kinds: section racks for the production of comb honey and shallow frame boxes for extracted honey. Section racks consist of a wooden frame, just the size of the brood chamber, $4\frac{1}{2}$ inches deep, with a slatted bottom to hold the sections in position. Sections are purchased in the flat, and can be folded into a square measuring $4\frac{1}{4}$ by $4\frac{1}{4}$ inches, being held in position by lock joints at one corner. A groove in the top provides the means of fastening the foundation, which in this case is very thin and transparent, for, as the honey and wax is all consumed by the purchaser, it would be rather disagreeable if there were a thick mid-rib to come in contact with the teeth.

The sections are placed in seven rows of three upon the slats in the rack; each section has a small piece removed from either edge top and bottom to allow the bees to pass in at the bottom, and also when other racks are placed in position to pass out at the top into them. Between each row of sections is placed a metal divider, to prevent the bees extending the comb beyond the wood-work of the section; if they did this it would be difficult to make the section into a saleable package. Each section when filled with honey and sealed over contains approximately one pound, and they are sold in normal times for one shilling each.

To prevent the queen from entering the sections, depositing eggs, and spoiling them with brood, a perforated metal sheet, called a queen excluder, because the perforations will allow

the workers to pass through but debar the queen, is laid over the top of the frames after the quilts have been removed, the rack is placed over this, and the quilts on top. The bees, finding they have more room, go up, build out the combs, and fill them with honey instead of swarming. When the first rack is about two-thirds full of honey it is lifted up and a second one placed underneath; this is repeated until the honey flow ceases, about the end of July.

The shallow frame super is used in exactly the same way. The frames are fitted with stout drone base foundation; this gives the bees an opportunity to exercise their desire to build drone comb in a place where it will be harmless; the larger cells also allow the honey to be extracted more easily than is the case with the smaller worker cells.

If desired, section racks and shallow frame supers can be used in conjunction on the same hive, instead of devoting it to one kind of super only.

When the combs in the super are filled with honey, and all the cells sealed over, they are removed by means of a bee escape, which is a small metal trap fitted into a board the size of the top of the brood chamber. This is slipped under the super to be removed in the evening; during the night the bees pass through the trap to the chamber below, from which they cannot return, so that the next morning the super can be taken off free from bees.

In the case of sections they are removed, cleaned, and stored away ready for sale. If it is a shallow frame super, then it is necessary to extract the honey. To do this, the cappings are first cut off from either side with a carving knife, previously heated by dipping it into hot water—a cold knife would tear the combs instead of cutting them. The combs are then placed, two at a time, into the cage of an extractor; this consists of a large round tin, with a cage so fitted that it can be made to revolve very quickly by turning a handle on the top. When this is done with the combs inside, centrifugal force slings the honey out of the cells on to the side of the extractor, where it drains down to the bottom, and is drawn out by means of a tap into tins or jars through muslin to strain it. When one side of the combs has been extracted, they are lifted out, turned round, replaced, and the other side treated in the same manner.

The combs are then returned to the bees; they repair what little damage has been done and again fill them with honey.

At the end of the season the supers are removed, cleaned down, and stored away. The most profitable system of working bees is for extracted honey, for this reason: to make one pound of wax the bees consume from ten to twenty pounds of honey, therefore when a section is sold one of the most valuable assets (wax) goes with it. Shallow combs are never destroyed, but are used year after year; they are never used for breeding purposes, therefore are always perfectly clean. For every pound of wax preserved for use as combs in this way, the consumption of a large amount of food and much valuable time is saved to the bees.

Immediately after the honey harvest has been gathered preparation for the winter should be commenced. This in most districts will be about the middle of August. It is no use attempting to winter weak stocks. If there are such they should be united. This is accomplished as follows: Move the hives containing the weak lots not more than one yard per day when the bees are flying until they stand in pairs side by side. If moved more than this distance the bees will not find their way into the hive; as already pointed out, they locate position and not the hive, so a great many will be lost. When they reach their final position, let them stand side by side and work for several days so that they get well used to the new location. On a fine warm evening, about six o'clock (normal time), remove all the combs from each stock that are not covered by bees, kill the worst queen, space the combs in one hive equal distances apart, having previously dusted the bees well with ordinary wheaten or pea flour. Now take the combs from the other hive one by one, dust the bees on each with flour and interspace them between the spaced combs in the other hive. Remove the empty hive, move the one containing the bees so that it stands in the centre of the space which was occupied by the two hives, wrap down warmly. The two lots of bees will have one common home and so winter successfully. Bees recognise each other by smell, hence the use of flour to give them all the same odour; if they are put together without this precaution they will fight and many bees will be killed, possibly amongst the number the most valuable one, *i.e.* the queen. Plenty of flour should be used in the operation; this is not wasted, the bees clean themselves from it, store it in the cells and use it for food in the same way that they collect and use pollen from the flowers.

If there are weak stocks in the spring, the same method can be followed to unite weak ones which would otherwise spend all the summer in gaining sufficient strength, and stores to winter on, instead of giving surplus. By uniting and making one strong lot out of each two weak ones, surplus will be obtained.

The next care will be to see that all stocks are headed by young vigorous queens. Those having failing mothers should be re-queened by young ones, reared and introduced as explained in the chapter on Queen Rearing and Introduction.

If there is plenty of honey in the brood combs for the bees to live on in the winter, there will be no need to feed. For this purpose there should be at least eight combs well filled and sealed over. If there is not this quantity then it will be necessary to feed with sugar syrup. It is well to remember that no food suits the bees so well as their own natural stores, therefore when removing the supers the bee-keeper should not be too avaricious; if it is found that a stock has bred so well all the summer that practically all the stores gathered have been placed in the supers, then, under present war conditions, it will save much trouble and expense if one superful is left on for food; if this is done the excluder must be removed or in the cold months it will prevent the bees from going through to the food.

If artificial food must be given it can be done in two ways: by means of a rapid feeder, which is a large vessel so constructed that the bees can get at the food *ad lib.*, carry it down and store it in the cells, or by means of the slow or stimulative feeder already described. The latter is the best plan, but requires more attention, therefore is not so much in favour. About the beginning of September the slow feeder should be placed in position and kept continually supplied with food; that given in the autumn differs in consistency from that given in the spring; for the former it must be thick, roughly half a pint of water to one pound of sugar. The bees are not active except on very fine days in the winter, therefore cannot cleanse. If thin food is given there will be much waste material, the retention of which in their bodies will cause dysentery. They should be allowed access to four or five holes in the feeder. The advantage of this system is that the queen is kept laying till late in the season, so providing a numerous colony to keep each other warm in the winter. The food taken and not required for immediate use is stored

in the cells and sealed over. If feeding is delayed until October, necessitating the use of the rapid feeder, then much of the food is left unsealed in the cells and may cause dysentery.

During very cold weather, the bees will not pass under the combs upon which they are clustering to others containing food; for this reason it is quite possible after a long spell of cold weather to find bees dead from starvation, with food on the next combs. To avoid this, as they will pass over the top of the combs, winter passages are given, by laying a couple of pieces of wood, about half an inch square and nine inches long, over the top of and at right angles to the frames so that they hold up the calico quilt sufficiently to allow the bees to pass over.

A disinfectant in the form of specially prepared naphthaline balls, split in two to prevent the bees rolling them out, is placed in the brood chamber on the floor as far away from the entrance as possible; this prevents disease and also keeps away wax moth, earwigs and ants.

To prevent all possible chance of the bees running short of food, a cake of bee candy, in a glass-topped box so that the supply can be watched in the winter without disturbing the bees, is placed over the feed hole. Cover down with at least three good thick quilts, or an abundance of folded newspapers.

The hive must be absolutely water-tight; to this end it is well to give each roof a coat of paint in the autumn, to prevent the driving rains and melting snow from penetrating. To secure the roof from being blow off during the winter and early spring gales, drive a stake down at one side and close up to the hive, tie a cord to it, and pass it over the roof; to the other end tie a brick so that it just swings clear from the ground.

The entrance to the hive is kept open full width in the summer; in the early spring and autumn, and also when feeding, it is closed to about an inch; for winter it is opened to six inches.

No attention is required in the winter beyond seeing from time to time that the candy supply is not exhausted, clearing the entrance from dead bees by means of a piece of stick, clearing away snow from the alighting broad and shading the entrance so that reflected light from the snow does not enter the hive and attract the bees out to die.

The correct recipes for making the foods described are as follows:

Spring and summer food—	Autumn food—
5 lb. white cane sugar.	5 lb. white cane sugar.
3½ pints water.	2½ pints water.
½ oz. vinegar.	½ oz. vinegar.
½ oz. salt.	¼ oz. salt.

Put the ingredients in a saucepan and place it over the fire, stir continually until all the sugar is dissolved, when it is ready for use. It is important to remember that white cane sugar and not brown sugar must be used. If the latter or beet sugar is used it will cause death through dysentery.

To make Bee Candy.—In a clean pan put 3 lb. of best white cane sugar and half a pint of water, together with as much cream of tartar as can be heaped on a sixpenny-piece. Stand beside the fire, stirring occasionally, until the sugar is dissolved, then place on the fire and stir continually until the mass boils; allow it to boil for about two minutes, then remove from the fire, and stand the pan in another vessel containing cold water until the syrup begins to cloud, then stir well until it reaches the consistency of porridge, when it can be poured into glass-topped boxes, or into saucers lined with paper, so that it can be lifted out in a block with the paper adhering; this can be put over the feed hole with the paper uppermost, but is not so convenient as the boxes with a glass top. The latter are easily made by glazing one side of a section. When set, the candy should not be hard, but a moist solid mass which can easily be cut into with the finger nail.

Candy given in January should have about a quarter of a pound of Symington's pea flour mixed with the above quantity. This should be lightly sprinkled in when stirring during the cooling process.

To medicate any of the above foods when dealing with Foul Brood, add to each pound of sugar as much naphthol beta as can be heaped on a threepenny-bit. Dissolve this in methylated spirit, whisky, or sweet spirit of nitre, and add to the food when cool.

V

HANDLING BEES

THE idea that bees will sting upon the slightest provocation, or even without this, is a very prevalent one amongst people who know very little about bees and their ways. Needless to say it is quite erroneous. The sting is given to them as a weapon of defence and not for offence.

The essentials for handling bees with the minimum amount of stings—it would be foolish to suggest that bee-keepers never do get stung—are quiet but firm manipulation, a knowledge of their habits, and withal gentleness.

Bees should never be handled in cold or wet weather, nor yet too early in the morning or too late at night. The best time to deal with them is about midday when the sun is shining; there are then fewer bees in the hive, they are lively, and if they settle upon the person they quickly fly off, instead of creeping in amongst the clothes to seek warmth, which they will do in the early morning or very late at night. If they do this, then it is not a very pleasant experience, at either supper or breakfast, to sit down unexpectedly upon a bee, with its underside next the flesh. In cold weather the brood will be killed from exposure, and wet weather will do equally as much harm. At the same time it must not be imagined that bees cannot be handled at any other time than that given as *the best.* They can be handled at all times except those specially mentioned.

Those who have seen a swarm hived by their owner will have been struck with their docility upon that occasion. This is accounted for by the fact given in the chapter dealing with swarms, that the bees are full of food; when in this condition they are good-tempered and disinclined to sting. The difference between the temper of bees in a swarm that has just issued and one that has been out for several days and exhausted their food will be painfully apparent to any person hiving them.

Whenever they are frightened bees always prepare for contingencies by filling their stomachs with sufficient food to last them several days. Knowing this failing, the bee-keeper takes advantage of it to get the bees under control.

They are very frightened of smoke and also the [illegible] carbolic acid, therefore either of the

subjugator. The former can be blown into the hive from a pipe or cigarette, but usually an appliance called a smoker is used. This is a tin cylinder having a removable conical nozzle with the pointed end open, the other being like the bottom of an ordinary tin. This is fastened on to the top of a small pair of bellows with a connection between the two at the bottom end. Ordinary thick felty brown paper or corrugated paper is rolled into a cartridge to fit the barrel of the smoker; this is lighted at one end and put in the barrel with the lighted portion furthest away from the nozzle. The bellows are then worked, when the air passing through the lighted cartridge carries the smoke out at the open nozzle in a dense volume.

If it is intended to use carbolic fumes, then a calico cloth, just a little larger than the top of the brood chamber, is sprinkled with a weak solution of carbolic acid and water. This, when not in use, should be kept in an air-tight tin to prevent the escape of the odour.

When manipulating bees it will be necessary to protect the face. This should always be done by wearing a veil. It should be of ample proportions, and be constructed of white mosquito netting for coolness, with a black panel of black silk net in the front to enable the operator to have the best possible vision. The veil should have an elastic band at the top and bottom to make it fit tightly and prevent bees from getting inside. It should be worn on a hat with a very wide brim to hold it clear from the face.

Gloves should not be worn as they make the fingers clumsy and mitigate against gentle handling. The sleeve cuffs should be secured with elastic bands to prevent the bees creeping up, the trouser bottoms either tucked into the socks or treated the same as the sleeves.

When it is necessary to attend to the bees, proper preparation should be made. Have everything ready, decide upon the work to be done, carry it out as expeditiously as possible, then shut the bees down and leave them alone. Compatiable with good management, the less bees are disturbed the better they will thrive. Constant meddling is one of the mistakes perpetrated by the beginner.

The following procedure will give an idea of how the work should be carried out, but one practical demonstration by a [illegible] is better than much reading of how to do it.

operated upon and blow a few puffs

of smoke in at the entrance, say about half a dozen; too much is injurious and will stupefy the bees, the very thing which must be avoided. Wait for about a minute to give the bees time to fill themselves with food, then quietly take off the roof and lift, turn back the corner of the quilt and blow a few puffs of smoke along the tops of the frames to drive the bees down. If a carbolic cloth is being used, take off the roof, turn back the quilts, letting the cloth follow them and take their place, remove it and replace the quilts for about a minute. Commence on one of the outside combs, lifting it up by means of the lugs at either end, examine one side, then reverse it to examine the other side; this must be done carefully and methodically, it must not be turned flat, but reversed in such a manner that it is kept edgewise the whole of the time. If turned flat in hot weather, the comb being soft is liable to break away from the frame. The same precautions must be observed in returning it to its original position. The comb can now be reared up against the outside of the hive to provide room to manipulate the others. Only the comb actually to be removed from the hive should be uncovered at one time; as they are put back they must be covered with a second quilt, *i.e.* one quilt follows up the other.

Never stand in front of the hive to manipulate or the outcoming bees, resenting the hindrance, will sting. Don't kill a single bee by crushing, through careless or rough treatment of the combs; if this is done the smell of the formic acid from the damaged poison sac will irritate the other bees and cause them to sting when otherwise they would not do so.

VI

OBTAINING HEATHER HONEY

HEATHER honey is obtained mainly in Scotland and Wales, but a fair amount is also gathered in the north of England. The honey is of a dark amber colour, gelatinous in consistency, very pungent in odour, and bitter-sweet to the taste. The honey is not much favoured by people living in the south, but is highly prized by northerners. The harvest is gathered in the latter part of August and the beginning of September. Owing to unsuitable weather for the bees to work frequently prevailing at that period, the crop is a very precarious one. The honey sells for just double that obtained

ordinarily, for that reason it is well worth extra effort on the part of the bee-keeper to obtain a crop from this source. In the north it is no unusual thing for the bee-keeper to take immense trouble to move his bees for many miles to the moors when the heather is in bloom. For this reason it is necessary to use a special hive, in which arrangements are made for ample ventilation when the bees are being moved.

The stocks that are going to the moors are prepared by rapid feeding, so that they fill up the cells in the brood combs; this compels them when at the moors to store all they obtain in the supers. The supers, whether section racks or shallow combs, are supplied with comb ready drawn out. The nights are so cold at this period of the year that wax secretion by the bees is well-nigh impossible; they can manage sufficient for the cappings, but that is about all.

When placed in position on the moors, it is usual to give a shepherd or gillie a few shillings to keep an eye on them; they must have plenty of good warm wrappings, on and round the supers, otherwise very little work will be done.

At the end of the heather bloom they are taken home intact, the supers being removed at leisure when they have recovered from the excitement of the journey.

Owing to the honey being so thick it is impossible to extract it by the ordinary centrifugal method. The combs are cut out, tied in cheese straining cloth, and put in a special press, which, by turning a screw, applies great pressure, which squeezes it out through the straining material, the wax being left behind in the latter.

If shallow combs are used, they have to be refitted for future use with foundation and the combs built again; so much food and time is wasted, the wise bee-keeper therefore obtains as many drawn-out sections as possible. This is done by extracting uncompleted ones at the end of the ordinary honey harvest; no spoliation of combs then occurs. The completed heather sections are sold as they are, while the uncompleted ones are squeezed to provide the extracted honey required.

VII

REARING AND INTRODUCING QUEENS

QUEEN-REARING is one of the most interesting and profitable branches of bee-keeping. The success of the calling depends

almost entirely on having good stock. Before the advent of the "Isle of Wight Disease" the best stock to use was undoubtedly BRITISH. It has been found that they do not resist the disease so well as hybrids. The Dutch bee which has been boomed by some papers should be shunned as a plague. They are not, as is repeatedly claimed for them, immune from I. of W. Even if they were, the advantage would be far outweighed by their great swarming proclivities. It is no unusual thing for a person to commence the season with one stock of Dutch bees and finish up the season with twelve stocks in the garden. The bee-keeper has a great deal of excitement in hunting after and hiving these swarms, but the return in honey is nil.

Even in the smallest apiary queens should be reared. It is not necessary to adopt the elaborate methods followed by the queen breeders on a large scale.

The best variety of bees to keep at the present time are Italians or Italians crossed with British drones, called Italian hybrids.

The stocks from which the queens and drones are to be obtained should be chosen the year previous to that in which they are required. The selection should take place with the following facts in mind. Working qualities and constitution come from the mother, while disposition is transmitted by the father. Stocks which are vicious in temperament should not be allowed to rear drones. This is avoided by close spacing the frames in the brood chamber, by withdrawing to the extreme end each alternate metal end, then pushing all the combs close together; if drones are being reared in the cells it is impossible for them to get out.

Early in the year, say about the first week in April, both the stocks from which drones and queens are to be obtained should be stimulated to get them as strong as possible by the end of the month. When that period arrives the stock set aside for the production of drones can be left alone, beyond putting on the supers at the proper time. The one from which the queens are to be procured should be teeming with bees. From it a nucleus is made as follows:

On the morning of a fine warm day have ready an empty hive; it should contain a division board; this is a board made to fit inside the brood chamber, but not too tightly, and is used to contract the size of the brood chamber to keep the inhabitants warmer when the full complement of ten combs

are not in use. From the queen-rearing stock take out three combs with the adhering bees, being very careful not to take the queen; one comb should have unsealed brood and eggs, the other two should have food only; the two outside ones are usually in this condition and they should be the ones taken. Place the comb containing the brood between the other two, to enable the clustering bees to keep it warm, close up with the division board and wrap down warmly. In the parent stock, the gaps made by the removal of the three combs are filled up by putting in their place frames fitted with full sheets of worker base foundation. They, too, may be supered in due course. The small lot, finding they are queenless, will immediately start to rear a queen. To ensure good results, it is advisable to break down the cell walls of several worker cells containing eggs; the best queens are reared from eggs and not from larva. If left to their own devices it is more than likely that the workers will make queens from the latter. The queen will eventually emerge from the cell, be mated to a drone, and commence to lay. She can then be removed and introduced to a stock requiring a young mother. To get further queens from the same stock, all that is necessary, after the queen has been removed from the nucleus, is to exchange one of its combs for another containing eggs from the queen-rearing stock, place it in the nucleus which, being queenless, will repeat the process of queen-rearing. This can go on until all the queens required have been obtained.

The nucleus should be made as near midday as possible. It should be populated by young bees which have never flown, so that when they do come out they locate the position of the nucleus hive. If old bees are taken they go out from the nucleus and return to the parent stock; the brood thus forsaken dies. At midday the old bees are out foraging; the young ones left at home are the ones obtained. If there are not sufficient bees on the three combs taken (there should be about a quart), the adhering bees on two other combs may be shaken into them, bearing in mind the avoidance of taking the queen. If bad weather prevails at any period, the bees in the nucleus must be fed.

When it is necessary to replace one queen with another in a stock, or give a queen to a queenless one, it is necessary to place her in such a position that she can acquire the scent of the hive, obtain food, and yet the bees be unable to get to

her. If they can do this they will kill her. The queen to be introduced is placed in a wire cage, together with attendant bees from her own stock, and a supply of food. This is hung between the combs and she is kept imprisoned for thirty-six hours; at the end of that time she is released and will be accepted. If a stock is to be requeened the old mother must be removed at least twelve hours before the other is put into the hive.

VIII

DISEASES

THE chief diseases to which bees are subject are Dysentery, Foul Brood, and Isle of Wight Disease.

In the case of dysentery, which is caused by bad ventilation, damp, or food containing too much moisture or which has fermented, the combs and interior of the hive are badly stained with the excreta of the bees; when in good health bees never foul their home. It makes its appearance usually in the very early spring. The treatment is to change the bees into a clean hive, remove all the stained combs possible, and feed with either candy or good warm thick syrup.

Foul Brood is a disease caused by a micro-organism which attacks the larvæ. Instead of lying curled up in the cell in the form of a C, and being pearly white in colour, the larva lies elongated, is flabby in appearance, gradually assuming a yellow colour turning eventually to a deep brown. The cappings covering the brood are sunken and have irregular perforations in them. In some cases an offensive odour is also present. If the disease is allowed to run its course, the colony soon succumbs. Affected bees should be fed on medicated syrup, Apicure placed in the hive, and renewed when it has evaporated, until the disease disappears.

Isle of Wight Disease is at present somewhat of a mystery; very little is known as to its cause. When affected, the bees come out of the hive and crawl about on the ground until they die. The wings are dislocated and the abdomen is badly distended, sometimes the bees are constipated, at others they evacuate profusely. In very bad cases the safest plan is to destroy the bees and burn all the internal arrangements of the hive. If slight, then a cure may be effected by feeding with syrup medicated with Izal or Bacterol.

The bees and interior of the hive should also be sprayed

with a solution of either of these drugs. The drinking fountain should be placed in such a position that it is protected against flying bees evacuating into it.

Whenever disease of any kind makes its appearance, the bee-keeper should be careful to disinfect himself after handling diseased stocks before going to healthy ones. No interchange of combs should take place. Hives that have contained diseased bees should be disinfected by scorching the inside with a painter's blow lamp before being put into use again.

IX

COST AND RETURNS

THE bee-keeper who is at all deft with tools can make many of the appliances required, even to the hives themselves, and so reduce very considerably the outlay necessary for the commencement and upkeep of the apiary. The prices given below are those prevailing in ordinary times. They fluctuate considerably, therefore about 50 per cent. may be safely added at the present. It must be borne in mind that the price obtained for the produce has also gone up. Extracted honey now sells in bulk at 1*s.* 9*d.* per pound against 6*d.* in normal ones. Sections fetch retail anywhere up to 3*s.* 6*d* each, against 1*s.*

	Prices: Lowest. £	*s.*	*d.*	Highest. £	*s.*	*d.*
1. Hive with ten standard frames, super, etc.	0	10	6	1	5	0
2. Feeder	0	1	3	0	1	9
3. Foundation, 1 lb.	0	2	6	0	2	6
4. Smoker	0	2	3	0	3	6
5. Super foundation	0	1	3	0	2	6
6. Extractor	0	19	0	2	10	0
7. Veil	0	1	0	0	1	6
8. Swarm	0	10	0	1	0	0
Total	2	7	9	5	6	9

The average clear profit is £1 per stock after the bees are established.

X

CALENDAR OF WORK FOR THE YEAR

JANUARY.—This is a season of rest and quietness in the Apiary. Keep the entrances to the hives clear from dead bees and shade from the sun when snow is on the ground. Repair and paint empty hives and appliances.

FEBRUARY.—Should doubt exist as to the food supply, give a cake of candy. Continue with repairs, etc.

MARCH.—If the weather be warm, without a cold wind, peep into the brood chamber by just raising the quilt. If food is short, give candy. The brood combs must not be disturbed by lifting out.

APRIL.—Stimulative feeding may now be done where food is required. If an abundance of food is present, bruise some of the food cappings. Place out the drinking fountain, taking care to shade it so that the flying bees will not soil it. Get ready brood frames and supers. Use full sheets of foundation in all cases.

MAY.—The hives will now become crowded; give room as required either by extra brood frames or supers. Make artificial swarms and prepare for queen rearing. In bad weather continue syrup feeding.

JUNE.—Look out for swarms. Put on extra supers where required, taking care always to put empty ones under the full ones. Newly hived swarms must be fed for at least a week. Carry out queen rearing.

JULY.—Supering will now be in full swing. Remove sections as completed. Shade the bees from the sun. Watch and see that the brood combs do not become clogged with honey. Should this occur, take out a couple and extract the honey and return them. Carry out this work in the evening to prevent robbing.

AUGUST.—The Heather harvest will now be on in those districts where moors exist. Take full advantage of it by using drawn-out comb in the supers. Watch for robbing and contract the entrances to the hives. Remove all supers; do this work in the evening, taking care to place those removed where they are inaccessible to bees, or robbing may commence Those stocks requiring fresh queens should have them introduced this month. Unite weak stocks and commence to feed those which have very little food in the combs.

SEPTEMBER.—All supers should be extracted and the shallow combs given to the bees to clean down, after which they should be cleaned and stored away in a dry place, protected from wax moth, ready for use again next year.

OCTOBER.—The bees should now be prepared for winter. Those with insufficient food should be fed rapidly. Wrap down warmly and open the entrances to about five inches. Faulty roofs should have a couple of coats of paint.

NOVEMBER.—The bees should now be snug for the winter and should not be molested at all. Finish cleaning appliances and storing them for the next season.

DECEMBER.—The bees are at rest, so the beekeeper can do likewise.

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THE RESULT IS CERTAIN

Thousands of Bee-keepers have used, and are now using, "BACTEROL" for curing and preventing Isle of Wight disease with the same uniform success. The bees like it, the cure is very rapid, and, what is of remarkable importance, nearly every report speaks of it imparting to the bees a more vigorous life than they ever possessed before.

DIRECTIONS.—Medicate each pint of Syrup with 1 teaspoon of General "BACTEROL." Stir in when Syrup is just warm or cold. See that all stores of honey are removed before giving Syrup.

Alternative Method.—Spray daily all crawlers on alighting board and in front of hive with a solution of 1 tablespoon of General "BACTEROL" to 1 quart of sweetened water. Use a mist sprayer, obtainable from any bee appliance manufacturer.

A 5 per cent. solution sprayed over and inside the hives will disinfect any excreta and destroy all germs and parasites.

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WELWYN, HERTS, ENG.

Isle of Wight Disease

8, Lon Isa, Rhubina Garden Village,
Whitchurch, near Cardiff,
October 10, 1917

Sirs,

I am a beekeeper in this district, and I thought my experience with "Izal" would be of interest. Last April I bought a bottle of ——— as a disinfectant for the prevention of Isle of Wight disease in my 3 stocks of bees, as this disease had been rather prevalent in this district for some time past. I sprayed my bees about once or twice a week with it, my bees being quite healthy then, but this was done just as a "preventative." But notwithstanding all my precautions, my bees contracted Isle of Wight disease, for on the evening of June 25th, when I arrived home from business, my bees were out in front of the hives in their thousands, crawling about, and on examination of the interior of the hives, the marks of excreta were plainly visible. I called in a local bee expert, and he diagnosed the case as a very bad attack of Isle of Wight disease, and advised me to destroy the lot, as he thought the case was hopeless. But I did not intend doing so without a struggle. The same evening I set to work disinfecting with the above-mentioned disinfectant, spraying combs and burying all crawlers. I continued this treatment for about a week, but disease was still as prevalent as ever. Then, as a last resource, I got a 1/- bottle of Izal, diluted it to 1 in 90 with lukewarm water, and started spraying bees with it. I had each comb of bees out, and sprayed them with it. Almost immediately I noticed improvement. I continued spraying with Izal of foregoing strength for about 2 weeks. At the same time I washed all floorboards, alighting boards, and other parts of the hives with 1 part Izal in 50 parts of water, giving the disease no rest; the bees were then busy gathering honey, and breeding fast, no crawlers anywhere, so I came to the conclusion I had, with the aid of Izal, cured the disease. A friend of mine also had an outbreak of the disease with his bees, and together we treated them the same; and in about 14 days we had cured his with Izal. Since then I have not had the slightest sign of the disease reappearing, and I have had a splendid lot of honey from them. If the foregoing experience of mine is of any use to you, you are at perfect liberty to use it in any way you please, as I am convinced Izal *cured* mine, and also my friend's bees.

Yours faithfully,

(Signed) H. W. ROBINSON,
Member Glam. B.K.A.

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